

\* symmetry operation

Table 1: Symmetry operations for 3d polar vector.

| No. | tag                                   | matrix (polar)  | det | TR |
|-----|---------------------------------------|---|-----|----|
| 1   | $\{1 0\}$                             | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$                       | 1   | 1  |
| 2   | $\{2_{001} 0\}$                       | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$                     | 1   | 1  |
| 3   | $\{m_{100} 0\}$                       | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$                      | -1  | 1  |
| 4   | $\{m_{010} 0\}$                       | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$                      | -1  | 1  |
| 5   | $\{1 0\frac{1}{2}\frac{1}{2}\}$       | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$   | 1   | 1  |
| 6   | $\{2_{001} 0\frac{1}{2}\frac{1}{2}\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$ | 1   | 1  |
| 7   | $\{m_{100} 0\frac{1}{2}\frac{1}{2}\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$  | -1  | 1  |
| 8   | $\{m_{010} 0\frac{1}{2}\frac{1}{2}\}$ | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$  | -1  | 1  |
| 9   | $\{1' 00\frac{1}{2}\}$                | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$             | 1   | -1 |
| 10  | $\{2_{001}' 00\frac{1}{2}\}$          | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$           | 1   | -1 |
| 11  | $\{m_{100}' 00\frac{1}{2}\}$          | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$            | -1  | -1 |
| 12  | $\{m_{010}' 00\frac{1}{2}\}$          | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & \frac{1}{2} \end{bmatrix}$            | -1  | -1 |
| 13  | $\{1' 0\frac{1}{2}0\}$                | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$             | 1   | -1 |

continued ...

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| No. | tag                          | matrix (polar)  | det | TR |
|-----|------------------------------|---|-----|----|
| 14  | $\{2_{001}' 0\frac{1}{2}0\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$ | 1   | -1 |
| 15  | $\{m_{100}' 0\frac{1}{2}0\}$ | $\begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$  | -1  | -1 |
| 16  | $\{m_{010}' 0\frac{1}{2}0\}$ | $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & \frac{1}{2} \\ 0 & 0 & 1 & 0 \end{bmatrix}$  | -1  | -1 |